4-25-2018

Homicide and the Effect of Racial and Ethnic Heterogeneity: Determining Individual Homicide Counts within the Aggregate Population

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HOMICIDE AND THE EFFECT OF RACIAL AND ETHNIC HETEROGENEITY: DETERMINING INDIVIDUAL HOMICIDE COUNTS WITHIN THE AGGREGATE POPULATION

by

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A Thesis

Submitted in Partial Fulfillment of the

Requirements for the Degree of

Master of Arts

The University of Memphis

May 2018

Acknowledgements

I would like to thank the University of Memphis for the opportunities and experiences it has provided me on my academic journey thus far. I would also like to thank the Department of Criminology and Criminal Justice for the chance to write this thesis. To my committee, Dr. James McCutcheon, Dr. Stephen Watts, Dr. Bert Burraston, and Dr. Shelley Keith I am so very thankful for the many great suggestions and helpful pointers you have given me during this process. Your words of encouragement and hours of one-on-one mentoring have made this project possible. I want to thank my family for supporting me during the writing of this thesis and never letting me give up my dreams of graduating. Without their love and support it would not have been possible to make it this far in my education. To my friends, I could not have done this without you. I especially want to thank my cohort Miguel Rocha, Peter Hart and Karli Province for spending many long nights and days working together as a team to motivate each other to finish the program.

Abstract

Recent literature suggests that the effect of racial and ethnic heterogeneity on homicide varies by aggregation. The current study intends to fill an important gap in the existent literature. The purpose of this research is to achieve a better understanding of how racial and ethnic heterogeneity impacts homicide by examining data at two different levels of aggregation in three different cities (Chicago, Memphis, and Baltimore). Racial and ethnic heterogeneity's relationship to homicide is examined at both the census tract and block group levels using data from the Chicago Data Portal, Memphis Police Department, and Baltimore Data Portal. Findings show that at the census tract and block group level, as racial and ethnic heterogeneity increases, homicide decreases in a quadratic relationship. Further research should be conducted to analyze the relationship at other levels of aggregation.

Key words: racial and ethnic heterogeneity, homicide, social disorganization theory

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Introduction

Considerable social science research applies a focus on how race and ethnicity affect homicide (Chon, 2012; Krivo & Peterson, 2000; Lee, 2000; Martinez et al., 2015). Much of this research is broken down by either race measures (Parker & McCall, 1999; Parker & Pruitt, 2000) or ethnicity measures (Chon, 2012; Martinez et al., 2008). Other research has examined both race and ethnicity measures on homicide (Boggess & Hipp, 2010; Martinez et al., 2016). The context of these studies varies based on the research question being asked but is usually aimed at explaining the variation in homicide by racial and ethnic grouping.

Within the context of community, racial and ethnic heterogeneity has been supported as an important factor (Sampson & Groves, 1989; Shaw and McKay, 1942). Racial and ethnic heterogeneity has been used as a common measure in the social sciences to measure differences in violent crime, such as homicide (Avison & Loring, 1986; Boesson & Hipp, 2015; Chon, 2012; Hansmann & Quigley, 1982). Blau's Index, developed in the 1977 book *Inequality and Heterogeneity*, is commonly used to structure measures of racial and ethnic heterogeneity in social science research (Avison & Loring, 1986; Chon, 2012; Hansmann & Quigley, 1982; McCall et al., 2010).

Racial and ethnic heterogeneity represents the diversity in a population. A measurement of racial and ethnic heterogeneity is vital when explaining the effect of racial and ethnic clusters on homicide across aggregation levels in cities. Some authors, such as Krivo and Peterson (2010) show the importance of taking into consideration the structural characteristics of areas under study when making comparisons between racial groups because of the impact these characteristics may have on violent crime statistics. Recent literature suggests that the relationship between racial and ethnic heterogeneity and homicide may differ based on the level of aggregation being used (Boesson & Hipp, 2015). Boesson and Hipp's (2015) research shows that scale is crucial for racial and ethnic heterogeneity and other distributional measures. Scale is crucial because these distributional measures depend on comparisons between groups of people within the population. Racial and ethnic heterogeneity will be used in the current study to help show the relationship it has with homicide at two levels of aggregation.

The current study adds to previously existing literature in a few ways. First, this research examines the relationship between racial and ethnic heterogeneity and homicide count at two levels of aggregation. By doing this, any changes that may occur within the relationship can be seen at relatively small levels of aggregation. The study also contributes to the literature on the topic by testing for quadratic effects between the independent and dependent variables. In past literature, the relationship between racial and ethnic heterogeneity and homicide count has usually been tested as a linear relationship. Nonlinearity in the relationship between these variables could be one reason why authors differ in their findings on whether heterogeneity or homogeneity elevate homicide within an area. Finally, the current study takes into consideration all races and ethnicities equally when performing the analysis rather than specifying one race.

Statement of the Problem

In some large cities, high numbers of homicide have been a problem on a consistent basis for a number of years. This study chooses three such cities to examine the effect of racial and ethnic heterogeneity on high counts of homicide from 2013-2015. The three cities under study within the current paper are Chicago, Baltimore, and Memphis. Homicide is operationalized using the FBI: Uniform Crime Reporting (UCR) Program's (2016) definition of murder and non-negligent manslaughter. The UCR defines murder and non-negligent manslaughter as, "the willful (non-negligent) killing of one human being by another" (UCR, 2016). This definition does not include situations such as deaths caused by negligence, suicide, or accident; justifiable homicides; and attempts to murder or assaults to murder, which are classified as aggravated assaults (UCR, 2016).

In 2013, the UCR reported statistics for murder and non-negligent manslaughter for each state and city showing the importance of focusing on the reduction of homicide. In 2013, the state of Illinois had 706 murders and non-negligent homicide cases (UCR, 2013, table 5). Out of the 706 cases, 414 occurred in Chicago (UCR, 2013, table 8). Maryland experienced 381 cases of murder and non-negligent manslaughter, with 233 cases occurring within the city of Baltimore (UCR, 2013, table 5; table 8). In 2013 Tennessee saw 328 murders and non-negligent homicide cases within its borders (UCR, 2013, table 5). Of these 328 cases, Memphis was responsible for 124 cases within the city (UCR, 2013, table 8).

Each of these cities contributes a high number of homicides to the number of homicides that occur within the states they reside in. During 2013, approximately 14,196 homicides occurred within the United States (UCR, 2013, table 5). The national rate was 4.5 homicides out of every 100,000 individuals as reported by the UCR (2013, table 5). Looking at the numbers for each of these cities, it is apparent that the homicide rates are far above the national average. This can be inferred based on the higher than average number of homicides occurring within Chicago, Baltimore, and Memphis.

The Literature

Much of the original research examining the relationship between race and homicide has focused on race specific homicide, rather than measuring racial and ethnic heterogeneity's impact on homicide counts and rates (Blau & Blau, 1982; Peterson & Krivo, 2005). Furthermore, many original studies have focused on the association between population heterogeneity and homicide based on Black population size and the relationship to violence it has in the United States (Chon, 2012). In a study done by Blau and Blau (1982), these authors find support for a positive relationship between homicide and a proportion of the Black population in the city. Others have found no association between a single racial proportion of the population (Braithwaite, 1979; Messner & Golden, 1985; 1992). A weakness of much of this type of homicide research is that it does not take into consideration other racial and ethnic minorities (Chon, 2012). By using a racial and ethnic heterogeneity index that accounts for all races and ethnicities within a population, the relationship can be better evaluated to understand how homicide count is impacted within a geographic area.

Understanding the original measure of heterogeneity developed in Blau's (1977) book *Inequality and Heterogeneity* is crucial in the context of the current study. This foundational piece of literature has shaped the use of racial and ethnic heterogeneity indexes in social science research into the present day. Blau's measure of heterogeneity was originally derived from the Simpson's Diversity Index. The Simpson's Diversity Index was used in ecology to quantify the biodiversity of a habitat and has since been modified to measure the probability that any two residents, chosen at random, would be of different ethnicities (Blau, 1977). Blau's Index, as it is now known, contains two primary dimensions. The two dimensions are (1) inequality and (2) heterogeneity. Prior to Blau composing his measure of heterogeneity, Gibbs and Martin (1962) composed an index of diversity as a measure used to determine variation in categorical data showing a perfectly homogenous population equal to zero and a perfectly heterogeneous population equal to one.

Gibbs and Martin's (1962) index of diversity is commonly used to measure racial and ethnic diversity within a city or other geographic area. Their index has incorporated elements of urbanization, technology, and division of labor and has since been used in tandem with Blau's Index. Since Blau's (1977) concept of inequality and heterogeneity, many other authors have expanded the use and definition of the measure. Avison & Loring (1986) explain Blau's concept of inequality, otherwise known as horizontal differentiation, as being, "based upon the distribution of the population among groups in terms of nominal parameters such as ethnicity, race, language, or religion" (p. 733).

Existing literature points to a positive correlation between racial and ethnic heterogeneity and homicide (Hansmann & Quigley, 1982; Avison & Loring, 1986; Chon, 2012; Boessen & Hipp, 2015). Racial and ethnic heterogeneity is an important concept in social disorganization theory because of the impact it has on the distribution of the population which can influence violent crime, including homicide. Some possible explanations for this positive relationship come from Shaw and McKay's (1942) work on social disorganization theory, as well as Blau's (1977) concepts of insulation within homogenous groups.

Social Disorganization Theory

Social disorganization theory, originally developed by Shaw and McKay (1942), is a complex and comprehensive theory that delves into neighborhood ecological characteristics, including racial and ethnic heterogeneity. Blau's Index is a way in which to measure heterogeneity in human ecology, originally derived from Park's conceptions of the city as a type of social organism based on earlier studies of plant ecology (Park, 1952). Park and Burgess laid the foundation for a model illustrating the relationship between ecology and disorganization of a community (1925) which led to the development of social disorganization theory. This model is based on Thomas and Znaniecki's definition of social disorganization. These authors define social disorganization as a “decrease of existing social rules of behavior upon individual members of the group” (Thomas & Znaniecki, 1958, p. 1128).

Park’s (1925) early research begins to break down the city into what he later refers to as a “superorganism” (1952). The city or “superorganism” is comprised of various symbiotic interrelations, which are referred to as an “organic unity”. “Natural areas” were one part of this “organic unity” and could be composed of various racially and ethnically diverse neighborhoods, income or occupational groups, or industrial or business areas (Park, 1952). Park defines “natural areas” as regions that perform a function and come into existence without design (Park, 1952). These areas have a natural history with characteristics that distinguish each one from another based on the culture contained within (Park, 1952). Park states that “every community is to some degree an independent cultural unit, has its own standards, its own conception of what is proper, decent, and worthy of respect” (1925, p.80). He goes on to say that the various natural areas within a city are not homogenous based on age and sex, but instead based on culture.

Based on these ideas of cultural identification within the “natural areas”, Park defines the process of “invasion, dominance, and succession” which refers to the progression seen within plant and animal ecosystems of new species coming in, and taking over an area from previously inhabiting species (Park, 1936). This concept is applied to his model of the city as a “superorganism” where one cultural group has been replaced by another cultural group through the shift of residents within a neighborhood (Park, 1936). The invasion process can be related to the concept of residential mobility imbedded in Shaw and McKay’s social disorganization theory, which has been said to contribute to disorganization within a neighborhood or community (Boggess & Hipp, 2015; Hipp, 2011; McDonald et al., 2013). This disorganization in turn leads to elevated crime occurring within that area.

Shaw and McKay (1942) state that, deteriorating structural conditions lead to social disorganization within neighborhoods. This relationship accounts for ecological variation that occurs within crime rates, such as the variation in homicide. Social disorganization theory operates from loose assumptions taken from the Darwinian law of survival of the fittest, as well as parallels drawn between the "distribution of plant life in nature and the organization of human life in societies" (Hawley, 1968; Park, 1952). Shaw and Mckay (1942) argue that three primary structural factors lead to a breakdown of community social organization. These structural factors are low economic status, ethnic heterogeneity, and residential mobility (Kornhauser, 1978; Shaw and McKay, 1942). From these structural factors, Shaw and McKay (1969) come to three basic conclusions. Physical status, economic status, and population composition are the titles of these three basic conclusions.

Physical status is the concept that the highest rates of criminality occur in neighborhoods with high industry or commerce. Economic status refers to elevated rates of delinquency existing in areas of lowest economic standing. The third conclusion, population composition, describes the relationship between high concentrations of foreign born or Black heads of families and areas of increased delinquency (Shaw and McKay, 1969). Shaw and McKay include ethnic heterogeneity in population composition, finding support for the existence of elevated crime rates in areas of greater heterogeneity.

The structural barriers created in these types of environments hinder the development of formal and informal social ties that help promote a community's ability to solve problems (Parker & McCall, 1999). Increased disorganization stemming from structural barriers decreases the ability for residents to realize common values and therefore maintain social control within their environment (Bursik, 1988; Bursik & Grasmik, 1993). One argument supporting this theory comes from Kornhauser (1978) who argues that communities with low economic status, high residential mobility, and high heterogeneity are increasingly exposed to elevated levels of crime. Disruption of a community is believed by Shaw and McKay to account for variations in crime and delinquency, tested here with homicide data.

An additional possibility for this positive relationship between racial and ethnic heterogeneity and homicide could be taken from Blau's (1977) concepts of insulation and intergroup associations. Insulation is defined as, "the proportion of members of a group or stratum who have no social contact with other groups or strata" by Blau (1977, p. 277). Simply stated, insulation occurs when groups lack associations with outside members of other groups. Looking at this from a race and ethnicity perspective, more homogenous areas in a city tend to lack this intergroup connectivity because they are immersed in their own culture with little outside influence. The lack of association could contribute to conflict between groups who do not share the same cultural norms. These concepts can be linked to the arguments presented on population composition by Shaw and McKay in 1969. Related to the structural barriers of social disorganization theory, population diversity may present obstacles to group interaction which in turn creates problems of integration into society. This is measured within Blau's Index (Avison & Loring, 1986; Blau, 1977).

Blau (1977) extends the research started by Park (1925) and elaborated on by Shaw and McKay (1942) in his theory of inequality and heterogeneity by analyzing social structure to compose an index of heterogeneity. In his building of the theory, Blau took into consideration the structure of spatial association and size and number of groups as well as components of inequality. Spatial association is the degree to which things are arranged in space (Blau, 1977). In the context of racial and ethnic heterogeneity, spatial association refers to the groupings of racial and ethnic communities. Blau (1977) explains that conflict arises when social interaction is not integrative. This means that a high degree of insulation, or the proportion of a group who does not engage in association with another group, can contribute to a limitation of social interaction between groups (Blau, 1977; Blau & Blau, 1982). Social interaction and probability of intergroup relations increases in an area with a higher racial and ethnic heterogeneity (Blau, 1977). This is a logical concept; the more variety in race and ethnicity in a geographic area, the greater the chance for intergroup associations to form between people of different races and ethnicities (Emerson et al., 2002, p.757).

The proximity of these groups influences their involvement with one another, and contributes or takes away from the insulation experienced within the communities. Elevated insulation in areas where many different cultures reside in close proximity with one another increases the opportunity for conflict between groups, and therefore violent crime such as homicide, to occur. Sampson and Wilson (1995) discuss social isolation and its effect on crime within groups. Social isolation, related to the concepts of social interaction and association, occurs when intergroup involvement is low. Sampson and Wilson (1995) posit that macrosocial patterns of residential inequality contribute to social isolation and the ecological concentration of truly disadvantaged individuals, which can lead to structural barriers and cultural adaptations that have the ability to undermine the social organization of an area, inhibiting the control of crime (p. 38).

In addition to proximity, size of a group plays a role in the amount of interaction that occurs within that group. Blau (1977) states that as a group's size increases, the probability increases that association with many other persons may occur (p. 257). An increase in association with others is possible because of the probability that people have wide circles of acquaintances based on the size and population density of the community they live in. An increase in heterogeneity within groups may reduce discrepancies in intergroup relations by lessening the differences in intergroup involvement (Blau, 1977, p. 257). The increased contact between social groups increases the opportunity for interpersonal conflict between members of different groups which supports Shaw and McKay's (1942) argument that increased heterogeneity of a population leads to elevated crime rates within the community.

Racial and Ethnic Heterogeneity & Blau's Index

Racial and ethnic heterogeneity is a commonly used measure in social science research. This index measures the level of diversity within a population to determine relationships with dependent variables, such as homicide in the current study. A plethora of academic authors have used Blau's Index to measure racial and ethnic heterogeneity within their studies (Altheimer, 2008; Avison & Loring, 1986; Chon, 2012; Sampson & Groves, 1989;1997). Many of these authors utilize this measure in tandem with the theoretical implications of social disorganization theory. This measure has been empirically tested many times since its inception in the late 1970s. Blau's (1977) book *Inequality and Heterogeneity* provides a clear background on the theoretical reasoning behind the measure and illustrates how it can be tested in a multitude of ways ensuring validity in the measurement. This index is directly applicable to the use of racial and ethnic heterogeneity within research, providing a clear index of 0 (*a perfect homogeneity*) to 1 (*a perfect heterogeneity*) indicating the level of heterogeneity within a geographic area.

Authors have used the measure of racial and ethnic heterogeneity conceived based on Blau's Index in homicide research to examine how the heterogeneity of a population impacts the homicide counts and rates within various levels of aggregations. In the context of social disorganization theory, racial and ethnic heterogeneity is directly linked to the three primary structural factors (low economic status, ethnic heterogeneity, and residential mobility) Shaw and McKay (1942) incorporated in the original model. Low economic status refers to the socioeconomic status of communities who lack adequate money and resources (Sampson & Groves, 1989). Ethnic heterogeneity is the diversity of race and ethnicity within a geographic area (Shaw & McKay, 1942). The third and final structural factor, residential mobility, is defined as a transient population where individuals move into and out of a place often over time (Shaw & McKay, 1942).

It is also linked to influential work done in 1989 by Sampson and Groves showing that heterogeneity within a community increases crime and delinquency in that area by weakening the mediating components of social organization (Avison & Loring, 1986; Gartner, 1990; Graif & Sampson, 2009; Hansmann & Quigley, 1982; Kornhauser, 1978; Sampson & Groves, 1989; Shaw & McKay, 1942; Suttles, 1968)

Race, Ethnicity, and Homicide

Conflicting findings exist concerning the relationship between racial and ethnic heterogeneity and homicide. On one hand, some authors show support for elevated homicide rates in areas of greater heterogeneity (Avison & Loring, 1986; Chon, 2012; Shaw and McKay, 1942). Avison and Loring (1986) suggest that where more ethnic groups exist, crime will be greater. Chon (2012) finds that ethnic heterogeneity contributes to higher homicide rates in his study. He links this finding to Shaw and McKay's (1942) theory of social disorganization where they state that ethnic diversity in specific communities is one of the contributing factors in a disorganized community. An influence of the diversity of a population could be the loss of an ability to reinforce one's cultural values and norms amongst their ethnic group when they are frequently exposed to outside ethnic groups (Hansmann & Quigley, 1982). Chon (2012) states that this frequent exposure may affect social control by weakening the social bonds and shared values of the ethnic group.

In support of this notion, Sampson and Groves (1989) state that heterogeneity inhibits communication as well as patterns of interaction within a community (p. 781). Additionally, Kornhauser (1978) and Bursik (1988) propose that the more heterogeneous a community, the more crime that will occur there. This diversity in population is said to limit the capacity for effective communication, the formation of ties, and the achievement of common values to solve community problems that arise (Kornhauser, 1978). Bursik (1988) adds to this notion by positing that informal social control is reduced by heterogeneity which may lead to increased tensions, therefore possibly higher chances of conflict and violent crime, such as homicide.

On the other hand, authors have shown support for increased homogeneity causing elevated homicide rates (Boessen & Hipp, 2015). Boessen and Hipp (2015) find that blocks with more racial and ethnic homogeneity have the most crime. These authors focus on more structural characteristics, such as specific land use measures and scale. Land use measures are used to show how features of the environment impact levels of crime by creating opportunities and positioning where guardians might provide informal social control (Brantingham & Brantingham, 1984; Boessen & Hipp, 2015). Some of the land use measures that Boessen and Hipp (2015) use in their study include residential stability, population density, and vacant units. Hipp (2011) states that, "it is important to assess whether new residents are indeed entering the neighborhood or simply moving from another housing unit in the same tract" (p. 417). Residential mobility can make it more difficult to take accurate data on the current population within an area if a high turnover rate in the population exists. High turnover rate, known as residential instability, can influence social disorganization by breaking down the social ties and communication between individuals within the neighborhood or community.

Residential mobility, or instability, is a barrier to the development of friendship networks, kinship bonds, and local associational ties that increase a community's network of social relations (Kasarda & Janowitz, 1974, p. 330; Kornhauser, 1978; Sampson & Groves, 1989). This barrier in turn increases a community's level of disorganization, hypothesized to lead to elevated crime such as homicide. The opposite measure of residential instability is residential stability. Residential stability refers to the length of time an individual, or family resides within a neighborhood over time. The longer the period of time the individual or family stays in residence increases the stability of the home, and in turn the area. Because of this notion, residential stability is a measure that is thought to increase a community's organization (Sampson & Groves, 1989).

The characteristics of the community of population density and vacant units are measurements used to understand how the composition of demographic variables and physical structures can influence crime in a community. Increased population in an area may contribute to the scarcity of resources increasing the conflict within a community. Vacant units are related to the concept of disorganization within a community. Boessen and Hipp (2015) state that, "vacant units are expected to provide opportunities for offenders to gather, as well as to provide locations with a lack of guardians, hence, increasing crime opportunities" (p. 6).

Social disorganization theory has evolved over time to incorporate many different research ideas. Ecological theories of society, structural theories of criminology, and measurements of diversity within the population all fall within social disorganization theory to culminate in a wide view of crime and, specifically for this study, homicide. Social disorganization theory developed originally by Shaw and Mckay (1942) and expanded upon by many others sets the foundation for the current research examining the relationship between racial and ethnic heterogeneity and homicide. Using these theoretical constructs, the relationship between these variables is able to be better understood through the foundations of neighborhood culture as a precipitating factor in violent crimes such as homicide.

The Current Study

The previous literature on the impact of racial and ethnic heterogeneity on homicide was subject to certain limitations. Many of the studies looked at race specific homicide instead of incorporating an element of overall heterogeneity within the population (Blau & Blau, 1982; Peterson & Krivo, 2005). Without taking a measurement that includes all groups within the population, it seems unreasonable to generalize the findings of one group out to all other groups. Incorporating the entirety of the population can help in better understanding how racial and ethnic heterogeneity influences crime. Employing the index of heterogeneity Blau (1977) composed, all races and ethnicities are included within the models tested.

Moreover, many of these studies did not test the effects of the relationship between heterogeneity and homicide at various levels of aggregation to see whether a change took place based on population size. Prior research has failed to find a uniform effect of population diversity, specifically racial and ethnic heterogeneity, in homicide research. It is crucial to focus on scale when using distributional measures because they are dependent on groups of people within the population (Boessen & Hipp, 2015). By incorporating different levels of aggregation into the research, the changes, if any, can be seen in the relationship between the variables. The current study looks to examine the relationship of racial and ethnic heterogeneity on homicide count at two levels of aggregation. By incorporating the census tract and block group levels of analysis, changes in the relationship between racial and ethnic heterogeneity and homicide can be evaluated, if any exist.

It is posited that based on the level of aggregation, the relationship between racial and ethnic heterogeneity and homicide count will change in significance level. Previous studies have shown positive correlations between increased levels of heterogeneity and elevated homicide occurring within an area. Other studies have shown that increased homogeneity elevates homicide within various levels of aggregation. Little research, if any, has tested for linearity in the relationship between racial and ethnic heterogeneity and homicide count which may be a reason why these conflicting findings exist. Because of these reasons in addition to the fact that a lack of research exists testing the relationship between the independent and dependent variables at differing levels of aggregation, it is believed that the relationship will differ when aggregation is taken into consideration.

Data & Methods

Sample

Three cities are chosen for this study based on a few key factors. The first consideration to choosing the cities in this study are their high homicide counts. Additionally their population size and the diversity of the population were taken into account. Finally, the accessibility of homicide data was important when making choices on cities to incorporate. The three cities under analysis are Chicago, Memphis, and Baltimore. Each of these three cities consistently maintains status as some of the highest in homicide within not only their state, but also within the United States at large. In 2013, the FBI: Uniform Crime Reports (UCR) reported 414 murder and nonnegligent manslaughters known to law enforcement in Chicago. Memphis had 124 murder and nonnegligent manslaughter cases reported to law enforcement in 2013. Finally, Baltimore had approximately 233 cases of murder and nonnegligent manslaughters as reported by the UCR. Their high homicide counts are one of the primary reasons each city was chosen for this study.

Another consideration for choosing these cities is their population size. While Chicago leads by a wide margin in population, Memphis and Baltimore are comparable in population size. The Census Bureau reports Chicago's population as approximately 2,704,958 in 2016. According to the 2016 census, Memphis roughly has a population size of 652,717 and Baltimore is estimated to have 614,664 individuals living within its borders (U.S. Census Bureau, 2016).

Chicago maintains an open data portal for the city. This data portal is updated regularly with the offenses that law enforcement record. Homicide data is included in the dataset and available for download by the public along with the latitude and longitude of the offense. The homicide data for Chicago is pulled from a public safety file containing information on all crimes that have been reported by police since 2001. Crime is broken down by "primary type" which can be sorted to select only the homicide data for the years of interest. After downloading the dataset, homicide occurrences were extracted for 2013-2015. The location data is provided with the homicide data by X, Y coordinates and longitude and latitude indicators. The file also includes information such as a unique case identifier and case number that can be matched with the blocks in Chicago. Date and time are also provided with the homicide instances. Homicides that occurred from 2013-2015 are imported into ArcGIS to take a homicide count for each census tract and block group based on the longitude and latitude of the offense. From ArcGIS, an aggregated count variable is exported to the overall census tract and block group databases to be matched with the American Community Survey (ACS) economic and demographic variables for Chicago.

Similar to Chicago, Baltimore continually updates a public access data portal with information on homicide. The Baltimore data portal contains up to date homicide information with corresponding longitude and latitude records. Homicide data can be found under the heading “crime”. The particular map utilized in this study is titled “Homicides 2013-Present”. This map can be downloaded in a CSV excel file to obtain the homicide location through approximate latitude and longitude coordinates. The data omits any homicides that could not be geocoded in ArcGIS based on latitude and longitude. Homicide data for 2013-2015 was pulled and aggregated at the census tract and block group levels for the present study.

Baltimore’s data includes a variety of information on each homicide case. Date, time, location by approximate address, as well as latitude and longitude of the homicide, weapon used, and a few other variables are included in the excel table. For the purposes of this study, the information on date, time, and latitude and longitude of the homicide occurrence is included in the overall datasets for census tracts and block groups. After discerning the cases that are included in the study, the information is imported into ArcGIS to obtain a count variable at both the census tract and block group levels of analysis. Finally, the count variable is exported to the working thesis database to be paired with economic and demographic measures that come from the ACS one- and five-year estimates.

The Memphis Police Department previously provided data on homicides occurring from 2013-2015 to the faculty at the University of Memphis for use in projects such as this one. These data include location indicators by longitude and latitude. These indicators make it possible for the homicides to be plotted in ArcGIS. The data also includes time and date of offense, type of weapon used, and victim/offender relationship. Homicide location, time, and date are utilized in the current study to create homicide counts at the census tract and block group levels for the city of Memphis.

The importance of the longitude and latitude is paramount when calculating the homicide count for each city at both levels of aggregation under study. Without the correct longitude and latitude for each homicide case it would be much more difficult to geocode this information in ArcGIS. The Census TIGER files are utilized in building maps for each city at two levels of aggregation. TIGER files are created and maintained by the U.S. Census Bureau to use within Geographic Information Systems (GIS). Files are pulled for the boundaries of the three cities, the block group parameters, and census tract borders. These maps are used to calculate the homicide counts for the analysis. They also show a visual representation of the relationships between the dependent variable and independent variables.

A census tract level of analysis is important to include for many reasons. Patterns and characteristics within cities can become obscured when using higher level, more aggregate geographies. By breaking down the relationship at the census tract level, correlations can be seen on the smallest level of aggregation. It is also important to include analysis at the block group level to see if the relationship changes when the geographic parameters are enlarged to encompass more of the population at a relatively small level of aggregation (Boesson & Hipp, 2015; Hipp, 2007).

Variables

Dependent variable.

Homicide. The dependent variable is homicide count which was taken at the census tract and block group levels from January 2013 through December 2015. Homicide count is used in place of homicide rate to ensure that census tracts and block groups with smaller populations do not affect the model. Many census tracts and block groups do not have homicides for the years under study, therefore a rate based on the dependent variable would not be appropriate (Lanier & Huff-Corzine, 2006; Osgood, 2000) A count was taken for each level of aggregation in all three cities to accurately represent the homicides that occurred within these areas during the years 2013 - 2015. The FBI's Uniform Crime Reports (UCR) definition of murder and nonnegligent manslaughter was utilized to guide the collection of homicide data. The UCR defines murder and nonnegligent manslaughter as "the willful killing of one human being by another" (2017).

Independent variable.

Racial and ethnic heterogeneity. Data on race and ethnicity were gathered from the 2013 U.S. Census ACS to test the impact of racial and ethnic heterogeneity on homicide. The measure utilized in this study was originally composed by P.M. Blau (1977). The heterogeneity measure is calculated by taking one minus the squared proportions of the population in each racial and ethnic group producing a range from zero to one. The racial groups included in this heterogeneity measure are non-Hispanic White, non-Hispanic Black, non-Hispanic Asian, non-Hispanic American Indian/Alaskan Native, non-Hispanic Native Hawaiian/Other Pacific Islander, and non-Hispanic other racial groups. The ethnic group included in this measure is Hispanic, including any race. This measure of racial and ethnic heterogeneity is widely used in the social sciences (Blau, 1977; Boesson & Hipp, 2015; Burraston et al., 2017).

Economic Characteristics

Disadvantage. Many studies have used a construct of disadvantage at the macro level. Commonly used measures of disadvantage include percent in poverty, percent unemployed, and percent female-headed households with dependent under the age of 18 (Poole et al., 2018; Morenoff, Sampson, & Raudenbush, 2001; Sampson & Wilson, 1995; Ulmer et al., 2012;

Wilson, 1987). Other commonly used measures include percent of the population 25 years and older without a high school degree or General Education Diploma (GED), median household income (reversed), and percent vacancy (Burraston et al., 2017; Krivo, Peterson, & Kuhl, 2009). The measure of disadvantaged employed in the current study includes the *z* scores of the six U.S. Census (2013) items percent in poverty, percent unemployed, percent female-headed households with dependent under the age of 18, percent of the population 25 years and older without a high school degree or (GED), median household income (reversed), and percent vacancy. Percent vacancy was included because it falls within the parameters of economic variables. The reliability for the disadvantage index is $\alpha = .76$ at the block group level. The reliability for the disadvantage index is $\alpha = .52$ at the census tract level.

Population. Population is controlled for in this study for a few primary reasons. First, racial and ethnic heterogeneity is a measure derived from the population of a location. Without accurate demographic information on the population, no measure of racial and ethnic heterogeneity could be taken. Therefore, populations must be controlled for if the desire is to understand the effect that racial and ethnic heterogeneity has on homicide at any level of aggregation.

Analytic Strategy

Before running the final models, both racial and ethnic heterogeneity were squared to test for nonlinearity between the dependent variable, racial and ethnic heterogeneity, and the independent variable, homicide count. In addition, the population was naturally logged because racial and ethnic heterogeneity is a highly skewed variable. The median household income component of the disadvantage variable was rescaled by multiplying it by (-1.00) to match the direction of the other variables in the disadvantage score.

Correlations were run on all variables to test for multicollinearity in the models. Multicollinearity was found to be insignificant. Correlation tables also helped to clearly show the relationships between variables before the negative binomial regressions were run.

City nesting is controlled for in the models. Dummy variables are used to control for nesting, with Chicago used as the reference group. Nesting is controlled for because block groups fall within the boundaries of census tracts and this could pose issues with the analysis. Nesting is controlled for by using clustered standard errors. If nesting is significant, it can influence the results of a regression equation. This influence would be seen in the value of the standard errors.

For all census tracts and block groups, those with no population were excluded due to missing data. All homicides with no corresponding latitudinal and longitudinal coordinates are omitted. These cases are omitted because it is impossible to include them in the homicide count without being able to map them in ArcGIS at the census tract and block group levels of analysis.

For each level of analysis, model one in the regression tables allowed for racial and ethnic heterogeneity and homicide count to have a linear relationship. Model two allowed for racial and ethnic heterogeneity and homicide count to be tested as nonlinear. Utilizing STATA, a negative binomial regression is executed for both the census tract and block group levels. This study calls for a negative binomial regression because this type of analysis accurately shows the relationship between count variables, such as homicide, and the independent variables that are being analyzed (Osgood, 2000). A negative binomial regression is chosen over an Ordinary Least Squares (OLS) regression if it meets one or all of the flowing conditions: the data is not normally distributed and/or the standard deviation is higher than the mean.

In the present study, the data is not normally distributed with a significant positive skew which violates the assumptions of an OLS regression. Though the results do not meet both aforementioned conditions, a negative binomial regression is appropriate based on the poisson distribution of homicide counts in all three cities. A zero-inflated negative binomial regression (ZIP) was ruled out for analysis because a conventional negative binomial regression allows for overdispersion already and is easier to estimate and interpret with the data (Allison, 2012). Originally a ZIP was considered because of the large number of zeros represented within the homicide data, but after looking more closely at the data a negative binomial regression was found to be able to perform the analysis.

Table 1. Descriptive Statistics for 2013, 2014, and 2015 Census Tracts Homicides by City (N = 1,731)

Variable	*M*	*SD*	Minimum	Maximum
Chicago				
Dependent variable				
Homicide	1.00	2.01	0.00	15.00
Independent variable				
Racial and Ethnic Heterogeneity (*z* scored)	0.49	0.30	0.00	0.99
Control Variable				
Disadvantage (*z* scored)	-0.07	0.99	-2.35	6.32
Population (logged)	8.17	0.52	5.18	9.70
Memphis				
Dependent variable				
Homicide	2.19	2.39	0.00	11.00
Independent variable				
Racial and Ethnic Heterogeneity (*z* scored)	0.34	0.21	0.00	0.83
Control Variable				
Disadvantage (*z* scored)	0.29	1.00	-1.56	2.98
Population (logged)	8.23	0.54	6.69	9.66
Baltimore				
Dependent variable				
Homicide	3.96	3.79	0.00	17.00
Independent variable				
Racial and Ethnic Heterogeneity	0.31	0.21	0.01	0.80
Control Variable				
Disadvantage	0.17	1.00	-2.19	2.60
Population (logged)	7.95	0.46	6.61	8.90

Table 1 shows the descriptive statistics for all cities at the census tract level. Between three cities, 1,731 census tracts are analyzed in the current study. The means for each city are statistically significantly different from one another based on their means for every variable in the model at the (.001) level. Interestingly, Memphis had the highest logged population in the census tract model though it has the smallest overall population. The logged population value is thought to be reflective of the size of Memphis' census tracts in comparison to Chicago and

Baltimore's census tracts. Overall though Memphis has the smallest population, the census tract units are larger so a larger population was represented within them.

At the census tract level, the descriptive statistics for Chicago show that a mean of one homicide occurred within a census tract between 2013-2015. The standard deviation shows that per census tract, this mean could fluctuate by 2.01 homicides. The maximum number of homicides that occur within a census tract in Chicago during 2013-2015 is fifteen. For Memphis, the descriptive statistics table shows the mean number of homicides occurring within a census tract between 2013-2015 to be 2.19 with a standard deviation of 2.39. The maximum number of homicides in a census tract is eleven. Lastly, the mean number of homicides within a census tract in Baltimore over the three years under study is 3.96. This number may increase or decrease by 3.79 homicide as indicated by the standard deviation. Seventeen homicides is the maximum number of homicides that occur in one census tract in Baltimore.

Looking at the mean for racial and ethnic heterogeneity in Chicago, it can be seen that the mean heterogeneity of a census tract is 0.49 on the index over the course of the three year period. The heterogeneity of a census tract in Chicago may differ by 0.30 based on the standard deviation. At the census tract level in Memphis, the mean racial and ethnic heterogeneity is 0.34 and may differ by 0.21 according to the standard deviation. Finally, Baltimore's mean heterogeneity is 0.31 with a standard deviation of 0.21 by census tract for the three years under study.

Bivariate correlations are shown in Table 2 between all factors in the three cities under study. In Table 2 all three cities show significant negative correlations between racial and ethnic heterogeneity and homicide count, with some variation in the relationships. For each of the three cities, disadvantage is shown to be highly significant at the (.001) level with homicide in positive relationships. Disadvantage and racial and ethnic heterogeneity show significant relationships in all cities, with some variation between cities. In Chicago, the logged population is shown to be significant with homicide count (.01) in a negative relationship, significant with racial and ethnic heterogeneity (.001) in a positive relationship, and significant with disadvantage (.001) in a negative relationship at the census tract level. For Memphis, the relationships change a little bit between population and the other variables. Logged population is insignificant with homicide count, highly significant with racial and ethnic heterogeneity (.001) in a positive relationship, and highly significant with disadvantage (.001) in a negative relationship. Finally, in Baltimore disadvantage is found to be significant with homicide count (.05) in a positive relationship and insignificant with racial and ethnic heterogeneity. It is significant in a negative relationship with disadvantage at the (.01) level.

Table 2. Correlation Matrix Census Tracts (*N* = 1,731)

Variable	**Homicide Count**	**Racial and Ethnic Heterogeneity**	**Disadvantage**	**Population**
Homicide Count				
Chicago	1.00			
Memphis	1.00			
Baltimore	1.00			
Racial and Ethnic Heterogeneity (Zscored)				
Chicago	-0.27***	1.00		
Memphis	-0.22**	1.00		
Baltimore	-0.42***	1.00		
Disadvantage (Zscored)				
Chicago	0.52***	-0.08**	1.00	
Memphis	0.54***	-0.27***	1.00	
Baltimore	0.59***	0.41**	1.00	
Population (Logged)				
Chicago	-0.06**	0.21***	-0.35***	1.00
Memphis	0.09	0.23***	-0.42***	1.00
Baltimore	0.16*	0.13	-0.23**	1.00

* = p <.05; ** = p < .01; *** = p < .001

Table 3. Descriptive Statistics for 2013, 2014, and 2015 Block Groups Homicides by City (*N* = 5,256)

Variable	*M*	*SD*	Minimum	Maximum
Chicago				
Dependent variable				
Homicide	0.33	0.87	0.00	9.00
Independent variable				
Racial and Ethnic Heterogeneity (*z* scored)	0.16	1.01	0.00	0.99
Control Variable				
Disadvantage (*z* scored)	-0.14	0.97	-2.75	5.51
Population (logged)	7.08	0.46	4.28	9.14
Memphis				
Dependent variable				
Homicide	0.76	1.08	0.00	6.00
Independent variable				
Racial and Ethnic Heterogeneity (*z* scored)	0.30	0.23	0.00	0.97
Control Variable				
Disadvantage (*z* scored)	0.56	0.90	-1.27	4.00
Population (logged)	7.16	0.55	4.26	9.13
Baltimore				
Dependent variable				
Homicide	1.21	1.54	0.00	10.00
Independent variable				
Racial and Ethnic Heterogeneity	0.28	0.22	0.00	0.99
Control Variable				
Disadvantage	0.33	1.02	-2.90	3.61
Population (logged)	6.72	0.63	1.61	8.44

There are 5,256 block groups under analysis in the current study. The descriptive statistics shown in Table 3 for Chicago show that homicide has a mean of 0.33 with a standard deviation of 0.87. The maximum number of homicides that occur within a block group in Chicago is nine. For Memphis, the descriptive statistics table shows 0.76 homicides occurring on average per block group between 2013-2015. The standard deviation for Memphis is 1.08 homicides per block group. The maximum number of homicides in a block group is six. In Baltimore, the mean number of homicides occurring within a block group is 1.21 with a standard deviation of 1.54 during 2013-2015. Ten homicides is the maximum number at block group level.

Looking at the descriptive statistics for racial and ethnic heterogeneity in Chicago, at the block group level the mean heterogeneity is 0.16. heterogeneity ranges between block groups based on the standard deviation of 1.01 during 2013-2015. The most heterogeneity in a block group in Chicago is 0.99, which shows almost perfect heterogeneity. Memphis' mean heterogeneity at the block group level is 0.30 with a standard deviation of 0.23. The maximum heterogeneity that occurs within a single block group during the time is 0.97. Finally, Baltimore has a mean of 0.28 homicides and a standard deviation of 0.22. The maximum heterogeneity of a block group is 0.99 in Baltimore during 2013-2015.

In Table 4 bivariate correlations are shown between each variable at the block group level. For Chicago ($p < .001$), Memphis ($p < .01$), and Baltimore ($p < .001$) a significant negative relationship exists between racial and ethnic heterogeneity and homicide count. In each of the three cities, positive significant relationships are shown between disadvantage and homicide count at the (.001) level. Chicago has a positive significant relationship between disadvantage and racial and ethnic heterogeneity at the (.01) level. The relationship for Memphis and Baltimore regarding disadvantage and racial and ethnic heterogeneity is significant and negative at the (.001) level. The logged population in Chicago has a negative and significant relationship with homicide count (.001), while both Memphis and Baltimore show no significant relationship. For all three cities, logged population is positive and significant with racial and ethnic heterogeneity at the (.001) level. Finally, for Chicago, Memphis, and Baltimore logged population is negative and significant with disadvantage at the (.001) level.

Table 4. Correlation Matrix Block Groups (N = 5,256)

Variable	**Homicide Count**	**Racial and Ethnic Heterogeneity**	**Disadvantage**	**Population**
Homicide Count				
Chicago	1.00			
Memphis	1.00			
Baltimore	1.00			
Racial and Ethnic Heterogeneity (Zscored)				
Chicago	-0.19***	1.00		
Memphis	-0.11**	1.00		
Baltimore	-0.26***	1.00		
Disadvantage (Zscored)				
Chicago	0.41***	0.04**	1.00	
Memphis	0.40***	-0.15***	1.00	
Baltimore	0.41***	-0.30***	1.00	
Population (Logged)				
Chicago	-0.05***	0.25***	-0.13***	1.00
Memphis	-0.02	0.27***	-0.31***	1.00
Baltimore	0.02	0.17***	-0.17***	1.00

* = p <.05; ** = p < .01; *** = p < .001

Results

To test for nonlinearity at both levels of aggregation in the relationship between the independent variable, racial and ethnic heterogeneity, and the dependent variable, homicide, both disadvantage and racial and ethnic heterogeneity were squared in model two for each negative binomial regression performed. In addition, the population was naturally logged because racial and ethnic heterogeneity is a highly skewed variable. The median household income component of the disadvantage variable was rescaled by multiplying it by (-1) to match the direction of the other variables in the disadvantage score. This allows the variables combined in this disadvantage score to act similarly when being combined together. Chicago was used as the reference group in the models, so a comparison could occur between the three cities under study.

Table 5. Census Tract Negative Binomial Regression Model of Homicide (*N* = 1,731)

	Model 1		Model 2	
	Coefficients (SE)	IRR	Coefficients (SE)	IRR
Racial and Ethnic Heterogeneity (Z Scored)	-0.29*** (0.03)	0.71	-0.31*** (0.03)	0.73
Racial and Ethnic Heterogeneity Squared (Z Scored)			0.13*** (0.04)	1.14
Disadvantage (Z Scored)	1.50*** (0.06)	4.46	1.41*** (0.06)	4.10
Disadvantage Squared (Z Scored)	-0.34*** (0.03)	0.71	-0.31*** (0.03)	0.73
Memphis	0.34*** (0.09)	1.41	0.43*** (0.09)	1.53
Baltimore	1.27*** (0.09)	3.57	1.34*** (0.09)	3.81
Natural Log Population	1.00 (Offset)	1.00 (Offset)	1.00 (Offset)	1.00 (Offset)
Constant	-8.48*** (0.05)	0.00	-8.65*** (0.07)	0.00
Pseudo R_2	21.46%		21.70%	

* p < .05, ** p < .01, *** p < .001; Chicago is the reference city

Model one can be interpreted based on the Incident Rate Ratios (IRR) provided for the model. A one standard deviation increase in racial and ethnic heterogeneity results in a 29% decrease in homicide count. A quadratic relationship can be seen when disadvantage is Z scored in model one. This is denoted by the change from a positive to a negative relationship between disadvantage and homicide count. Memphis is shown to be 1.41 times higher in homicide than Chicago in model one and Baltimore is shown to be 3.57 times higher in homicide than Chicago. The coefficients shown for the logged population reflects population being set to zero in the model. The Pseudo R^2 shows 21.45% of variance explained in homicide count in model one for the census tract level.

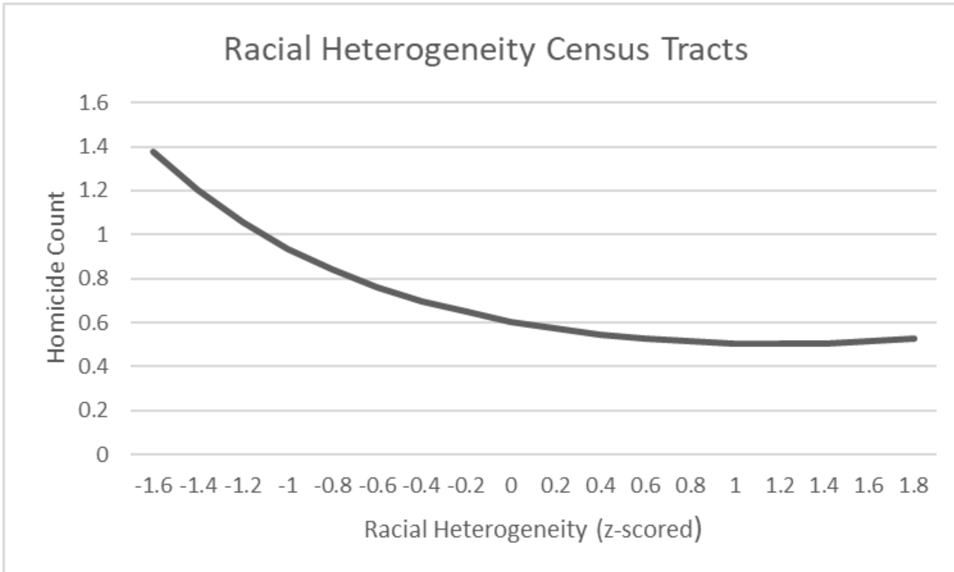

Figure 1. Linear relationship between racial heterogeneity and homicide count for Chicago, Memphis, and Baltimore at the census tract level. y=exp(-8.6506+ 8.1488 +(-.3086*m1)+(.1285*m1*m1))

Model two best fits the data at the census tract level because it specifies the relationship between racial and ethnic heterogeneity and homicide count properly. In model 2 we can see a quadratic relationship between racial and ethnic heterogeneity and homicide count, where in model one the relationship looked to be linear. Figure 1 clearly shows the relationship between these variables. As racial and ethnic heterogeneity increases, homicide count decreases until about the 0.60 point on the x-axis. The relationship then begins to plateau in a quadratic relationship. These figures are graphed at the mean population and mean disadvantage levels for census tracts.

Table 6. Block Group Negative Binomial Regression Model of Homicide (*N* = 5,256)				
	Model 1		Model 2	
	Coefficients (SE)	IRR	Coefficients (SE)	IRR
Racial and Ethnic Heterogeneity (Z scored)	-0.42*** (0.04)	0.65	-0.43*** (0.03)	0.65
Racial and Ethnic Heterogeneity Squared (Z scored)			0.15*** (0.03)	1.16
Disadvantage (Z Scored)	1.37*** (0.06)	3.95	1.31*** (0.07)	3.70
Disadvantage Squared (Z scored)	-0.30*** (0.03)	0.74	-0.28*** (0.03)	0.75
Memphis	0.03 (0.08)	1.03	0.10 (0.08)	1.11
Baltimore	1.06*** (0.08)	2.90	1.11*** (0.08)	3.05
Natural Log Population	1.00 (Offset)	1.00 (Offset)	1.00 (Offset)	1.00 (Offset)
Constant	-8.41*** (0.05)	0.00	-8.60*** (0.07)	0.00
Pseudo R_2	19.67%		19.92%	

* p < .05, ** p < .01, *** p < .001; Chicago is the reference city

Table 6 shows model one and model two for the block group level. We interpret model one based on the IRRs shown. The relationship between racial and ethnic heterogeneity is very similar to the census tract level showing that a one standard deviation increase in racial and ethnic heterogeneity results in a 35% decrease in homicide count at the block group level. For the block group level, another quadratic relationship exists between disadvantage and homicide count denoted by the change from a positive to a negative and significant relationship after squaring the variable. Memphis does not show to be significantly different in homicide count than Chicago, but Baltimore shows to have 2.90 times more homicide than Chicago at this level of aggregation. Model one explains 19.67% of the variance in homicide count at the block group level.

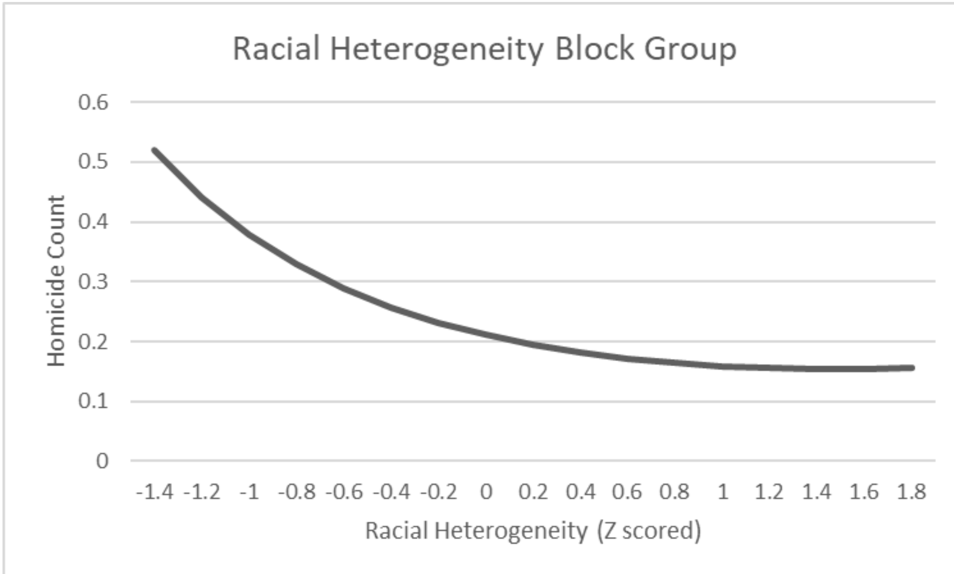

Figure 2. Quadratic relationship between racial heterogeneity and homicide count for Chicago, Memphis, and Baltimore at the block group level. y=EXP(-8.6005 + 7.0440 +(1.3077*M39)+(-0.2842*M39*M39))

At the block group level, model two best specifies the data because it shows the quadratic relationship that occurs between racial and ethnic heterogeneity and homicide count. It also explains more variance in the relationship, changing from 19.67% to 19.92%. We interpret model two based on Figure 2 which clearly shows the quadratic relationship that occurs when racial and ethnic heterogeneity is squared. As racial and ethnic heterogeneity increases, a decrease is seen in homicide count until approximately the .60 point on the x-axis. From this point forward, the relationship between these two variables plateaus. These figures are graphed at the mean population and mean disadvantage levels for block groups.

At lower levels, more heterogeneity within an area results in a smaller number of expected homicides. The more homogenous a population is, the larger the homicide count tends to be. There is a quick division between heterogeneous and homogenous populations when examining their influence on homicide count.

Something worth noting is the relationship between disadvantage and homicide count at both the census tract and block group levels. At the census tract level, the relationship is quadratic in nature between these variables, which means that increases in disadvantage increase the homicide count to a certain point but then level off similarly to the block group level. Another quadratic relationship is seen when looking at disadvantage and homicide count at the block group level. As disadvantage increases, so does homicide count up to a certain point and then this relationship flattens out. The relationships between disadvantage and homicide count should be explored in future research.

Discussion

This study tested whether racial and ethnic heterogeneity had an influence on homicide count at varying levels of aggregation in three major cities within the United States. Much prior research has been conducted on the relationship between race and homicide with inconsistent findings. Some studies demonstrated a positive relationship between racial and ethnic heterogeneity and homicide while other studies showed a negative relationship between racial and ethnic heterogeneity and homicide. The current study finds that where racial and ethnic heterogeneity is higher, homicide count tends to be lower both in the census tract and block group levels of analysis. The results show that the relationship between racial and ethnic heterogeneity and homicide are very similar between block group and census tract level. There were two major findings that could be taken from the results.

Major Findings

The first major finding showed that census tract level areas with more racial and ethnic heterogeneity seemed to experience lower levels of homicide in each of the three cities. A quadratic effect was uncovered between racial and ethnic heterogeneity and homicide. Both Memphis and Baltimore were significantly different in homicide count at the census tract level. Memphis showed to have 1.41 times more homicide than Chicago in model two. Baltimore showed to have approximately 3.57 times more homicide than Chicago at the census tract level.

The second major finding showed that areas with more heterogeneity at the block group level experienced fewer homicides. The relationship between racial and ethnic heterogeneity was quadratic at the block group level and looks very similar to the census tract level. This finding showed true for all three cities under study. When considering the relationship between racial and ethnic heterogeneity and homicide count, Memphis and Chicago had very similar relationships. Baltimore on the other hand showed to be approximately 2.90 times higher in homicide count at the block group level than Chicago in model two.

The lack of differences in the relationship between racial and ethnic heterogeneity may show that there is consistency or much similarity between census tract and block group. While consistent in the current study, there is much contrast between the findings in this study and other previous studies and theory. Social disorganization theory looks at variables such as poverty, disadvantage, heterogeneity, and residential instability to explain the fluctuation in crime levels. When applied to the current study, we can see that in areas of high racial and ethnic heterogeneity homicide tends to be lower in both levels of aggregation. Furthermore, as disadvantage increases, homicide increases both at the census tract and block group levels.

Additionally, at the block group level disadvantage was highly significant in the relationship between racial and ethnic heterogeneity and homicide showing areas that experience more disadvantage were more likely to experience high homicide counts. The relationship between disadvantage and homicide count was similar between census tracts and block groups. Each of these relationships was quadratic in nature meaning that as disadvantage increases, homicide count does as well but at a certain point the relationship plateaus.

The Possible Influences of Insulation

The findings of this study have a few implications for how researchers look at homicide and where it occurs based on racial and ethnic heterogeneity. In those areas where heterogeneity is high, the expectation is that homicide count will be lower as compared to areas with high homogeneity. Sampson and Wilson (1995) offer a possible explanation for this relationship. These authors show that in areas with a more homogenous population, elevated crime rates occur. Social isolation of a group could be one primary reason why this occurs. Social isolation is defined as, "the lack of contact or of sustained interaction with individuals and institutions that represent mainstream society" (Sampson and Wilson, 1995, p. 5; W. J. Wilson, 1987, p. 60). Social isolation can be nurtured by ecological concentrations of urban poverty. This concentration of poverty not only deprives residents in these areas of resources and conventional role models, but it also deprives them of cultural learning from mainstream social networks (Sampson and Wilson, 1995; W. J. Wilson, 1991).

Sampson's work on social isolation can be connected to Blau's (1977) concept of insulation. Blau defines insulation as, "the proportion of a group without any or that without a close associate in another group" (p.28). Simply stated, insulation is what occurs when there is no contact between two or more groups of people from different backgrounds. Relating Sampson and Wilson's (1995) possible explanation of social isolation to Blau's (1977) concepts of insulation, conflict is more likely to occur in areas where the population lacks intergroup relations. Intergroup relations are composed of three facets. These three facets are percent intermarried, mean number of intergroup associations, and mean amount of time spent in intergroup associations (Blau, 1977, p.27). Blau (1977) states that, "conflict involves social interaction that is not integrative…" which could help to explain why homicide occurs in areas that lack intergroup relations (p. 28). In the future, measures of social isolation and insulation may help to better explain the relationship between racial and ethnic heterogeneity and homicide.

Additional measures that would be beneficial to include in future research on this topic include measures of collective efficacy and income inequality. Sampson, Raudenbush, and Earls (1997) conducted an influential study examining the influence of collective efficacy on neighborhoods in Chicago. Sampson et al. (1997) define collective efficacy, “as social cohesion among neighbors combined with their willingness to intervene on behalf of the common good” (p. 918). Collective efficacy is a concept showing that members within a community who share common goals and values can control the behavior of individuals and groups within that community so that there is a safe and orderly environment (Sampson, 1995).Within their study, they found that measures of collective efficacy yield a high between-neighborhood reliability as well as being negatively correlated with variation in violence. This occurs even after controlling for individual-level characteristics, measurement error, and violence. Some factors mediated by collective efficacy include concentrated disadvantage and residential instability with violence (Sampson et al., 1997). Additionally, research performed by Bandura (2000) writes that, “perceived collective efficacy fosters groups’ motivational commitment to their missions, resilience to adversity, and performance accomplishments” (p. 75). These benefits of collective efficacy could be applied to a neighborhood’s response to violent crime, or prevention attempts when their ‘missions’ and ‘accomplishments’ are similarly shared, especially when considering homicide within their neighborhood or community.

Income inequality is an equally important measure to consider in the relationship between racial and ethnic heterogeneity and homicide when examining a variety of levels of aggregation. Just as racial and ethnic heterogeneity may change in relation to homicide based on the aggregation level, income inequality may experience this as well. Hipp (2007) found that greater overall income inequality in a census tract was associated with higher crime rates, particularly for violent crime types. Various levels of aggregation could change the way the relationship between income inequality and homicide behaves. Avison and Loring (1986) find that the positive effects of income inequality on rates of homicide provide support for structural theories of crime in a cross-national study of 32 nations. On the other hand, Chon (2012) found that the interaction effect between population heterogeneity and income inequality proposed by Avison and Loring (1986) and Blau and Blau (1982) was not related to national homicide rates. The relationship between income inequality, racial and ethnic heterogeneity, and homicide should be evaluated in further research.

An important consideration to make in research analyzing racial and ethnic differences in crime is the structural background of the area under study. Krivo and Peterson (2010) discuss racialized poverty and segregation where they look at the differences between white and minority communities as divergent social worlds. These authors show that the impact of the racial divide in the United States stemming from the nation's history of slavery and segregation have impacted neighborhood crime based on structural characteristics of neighborhoods and economic inequalities. These authors warn against conducting research that does not take into consideration the larger social context of racial structuring because it may lead to oversimplified explanations for why crime rates are much higher in nonwhite versus white areas. Future research on this topic will focus on understanding how the relationship between racial and ethnic heterogeneity and homicide may differ based on structural characteristics of neighborhoods and differing levels of inequality.

Limitations & Future Directions of Study

Some of the limitations within the current study focus on the sample. With only two levels of aggregation represented within the work, differences can only be inferred between the census tract and block group levels of analysis. Future research done on this topic should include additional levels of aggregation such as the zip code and county levels of aggregation. By using a variety of levels of aggregation, the change or lack of change in the relationship between racial and ethnic heterogeneity and homicide count could be better expanded. There may be larger changes in this relationship in aggregation levels with higher populations such as the zip code level of analysis.

Additionally, the results of this research are only generalizable to the population under study in Chicago, Memphis, and Baltimore. These three cities were chosen based on their high homicide counts, population sizes and demographics, and the availability of data. Chicago and Memphis had comparable rates of homicide while Memphis and Baltimore had comparable population sizes. Each city had a good mixture of race and ethnicity within their population as well. In the future it would be helpful to include more cities within the analysis to further strengthen the findings.

Future research should include additional cities with varying homicide rates. Cities such as Detroit, New Orleans, St. Louis, and Birmingham among others could be incorporated to add additional high homicide rate cities. New York and other cities with large populations and low homicide rates would be interesting to add in the model as well. Smaller cities could also be incorporated in the study to provide a range of population sizes. Cities such as Waco, TX, Southbend, IN, and North Charleston, SC all have estimated populations around 100,000 with high homicide rates. By adding a variety of cities to the study, the relationship could be evaluated to better understand how racial and ethnic heterogeneity predict homicide in a wider variety of locations.

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